

IN THE CLAIMS:

1. (Currently Amended) A bone fixation assembly comprising:  
a bone fastener comprising a head, a shank sized and configured to be anchored into bone, and a at least one collar arranged in-between the head and the shank, the at least one collar having a top surface, a bottom surface and a lateral sidewall extending between the top surface and the bottom surface, the intersection of the lateral sidewall with the bottom surface forming a substantially sharp edge portion and a plurality of lower portions, ~~at least two adjacent lower portions forming at least one edge~~; and

a receiving member comprising at least one bore that defines an inner surface having a first portion and a second portion, the first portion has a substantially constant diameter and the second portion is substantially concave;

wherein the sharp edge of the at least one collar contacts the concave second portion of the receiving member so that the bone fastener can be variably positioned with respect to the receiving member along the at least one edge.

2. (Canceled)

3. (Canceled)

4. (Canceled)

5. (Canceled)

6. (Canceled)

7. (Canceled)

8. (Canceled)

9. (Original) The bone fixation assembly of claim 1, wherein the concave portion has a radius of curvature and the ratio of half the diameter of the first portion to the radius of curvature is between about 0.5 and about 1.0.

10. (Original) The bone fixation assembly of claim 9, wherein the ratio of half the diameter of the first portion to the radius of curvature is between about 0.85 and about 0.95.

11. (Currently Amended) The bone fixation assembly of claim 1, wherein the fastener has a longitudinal axis and the at least one collar has a generally circular cross-section transverse to the longitudinal axis.

12. (Currently Amended) The bone fixation assembly of claim 11, wherein the at least one collar has a substantially constant diameter.

13. (Currently Amended) The bone fixation assembly of claim 12, wherein the at least one collar has a diameter is between about 4 mm and about 10 mm.

14. (Currently Amended) The bone fixation assembly of claim 12, wherein the at least one collar has a combined ~~has a thickness defined between the top portion and a lowest of the lower portions~~ between about 0.5 mm and about 2 mm.

15. (Original) The bone fixation assembly of claim 1, wherein the fastener head is convex with respect to the shank.

16. (Original) The bone fixation assembly of claim 15, wherein at least a portion of the fastener head is substantially semispherical.

17. (Original) The bone fixation assembly of claim 1, wherein the fastener head is integrally formed with the shank.

18. (Original) The bone fixation assembly of claim 1, wherein the fastener head is removably attached to the shank.

19. (Original) The bone fixation assembly of claim 1, further comprising a clamping member, wherein the clamping member is capable of locking the bone fastener with respect to the receiving member in a fixed configuration.

20. (Original) The bone fixation assembly of claim 19, wherein the clamping member is a grub screw.

21. (Original) The bone fixation assembly of claim 19, wherein the clamping member is releasably associated with the receiving member for releasably locking the assembly in a fixed configuration.

22. (Original) The bone fixation assembly of claim 19, wherein the clamping member is threadably associated with the receiving member.

23. (Currently Amended) The bone fixation assembly of claim 1, wherein the inner surface comprises a deformable material such that a form-fit connection is obtainable between the at least one collar and the receiving member.

24. (Original) The bone fixation assembly of claim 1, wherein the receiving member further comprises a channel extending transverse to a central axis of the bore, the channel configured and dimensioned to receive a longitudinal support.

25. (Canceled)

26. (Currently Amended) A device for osteosynthetic bone fixation comprising:  
a bone fastener comprising a plurality of collars and a shank sized and configured to be anchored into bone, each the collar having a top planar surface, a bottom planar surface and a lateral sidewall extending between the top surface and the bottom surface, the intersection of the lateral sidewall with the bottom surface forming a substantially sharp edge portion and a plurality of lower portions, at least two adjacent lower portions forming at least one edge; and

a receiving member comprising at least one bore that defines an inner surface with a first cylindrical portion and a second non-cylindrical portion,  
wherein the sharp edges of the collars at least one edge abuts the non-cylindrical portion at a selectable angle.

27. (Currently Amended) The device of claim 26, wherein the bone fastener has a longitudinal axis and the collars are is disposed generally concentric to the longitudinal axis.

28. (Currently Amended) The device of claim 27, wherein the sharp edges are at least one edge is disposed generally concentric to the longitudinal axis.

29. (Currently Amended) The device of claim 28, wherein the sharp edges form a substantially circular line and wherein each edge is disposed along at least one edge is substantially circular, with each of the at least one edge being disposed along an imaginary convex surface.

30. (Original) The device of claim 29, wherein the imaginary convex surface is spherical.

31. (Currently Amended) The device of claim 27, wherein each ~~the~~ collar has a substantially constant diameter.

32. (Currently Amended) The device of claim 31, wherein the diameters are is between about 4 mm and about 10 mm.

33. (Currently Amended) The device of claim 27, wherein the collars have a combined ~~has a thickness defined between the top portion and a lowest of the lower portions~~ between about 0.5 mm and about 2 mm.

34. (Original) The device of claim 27, wherein the bone fastener further comprises a head that is convex with respect to the shank.

35. (Original) The device of claim 34, wherein at least a portion of the head is substantially semispherical.

36. (Original) The device of claim 34, wherein the head is integrally formed with the shank.

37. (Original) The device of claim 34, wherein the fastener head is removably attached to the shank.

38. (Original) The device of claim 26, further comprising a clamping member, wherein the collar is releasably lockable by the clamping member.

39. (Original) The device of claim 38, wherein the clamping member is a grub screw.

40. (Original) The device of claim 38, wherein the clamping member is a nut.

41. (Original) The device of claim 27, wherein the receiving member further comprises a channel extending transverse to a central axis of the bore, the channel configured and dimensioned to receive a longitudinal support.

42. (Canceled)

43. (Previously Presented) A bone fixation system comprising:  
a bone screw having a longitudinal axis,  
a head;  
a shank; and  
a collar disposed between the head and shank and comprising a top portion and a plurality of lower portions, at least two adjacent lower portions forming at least one edge generally concentric to a longitudinal axis of the bone screw, wherein each edge is disposed along an imaginary convex surface that is generally spherical; and  
a receiving member comprising at least one bore having a longitudinal axis, the bore defining an inner surface having an upper portion and a lower generally spherical portion for contacting the imaginary convex surface for permitting the longitudinal axis of the bone screw to be angulated with respect to the longitudinal axis of the bore.
44. (Original) The bone screw of claim 43, wherein the collar has two edges.
45. (Original) The bone screw of claim 43, wherein each edge has a diameter, and the diameters of the edges decrease as a function of increasing distance from the head.
46. (Original) The bone screw of claim 45, wherein the collar is disk-shaped.
47. (Original) The bone screw of claim 43, wherein the head is convex with respect to the shank.
48. (Original) The bone screw of claim 44, wherein at least a portion of the head is substantially semispherical.
49. (Original) The bone screw of claim 48, wherein the head is integrally formed with the shank.
50. (Original) The bone screw of claim 48, wherein the head and shank are separately formed.
51. (Original) The bone screw of claim 50, wherein the head is releasably associated with the shank.
52. (Original) The bone screw of claim 50, wherein the head is threadably associated with the shank.

53. (Original) The bone screw of claim 50, wherein the head is connected to the shank by a conical peg that is received in a conical bore, with the conical peg and conical bore being disposed along the longitudinal axis.

54. (Original) The bone screw of claim 50, wherein the head is connected to the shank by a bayonet lock.

55. (Original) The bone screw of claim 48, wherein the head further comprises a zenith disposed on the longitudinal axis.

56. (Original) The bone screw of claim 43, wherein each edge forms a generally circular shape having a diameter between about 4 mm and about 10 mm.

57. (Original) The bone screw of claim 43, wherein each edge forms a generally circular shape having a diameter between about 8 mm and about 10 mm.

58. (Original) The bone screw of claim 43, wherein the collar has a thickness defined between a top surface and a bottom surface between about 0.5 mm and about 2 mm.

59. (Original) The bone screw of claim 43, wherein the shank has an external diameter between about 3 mm and about 6 mm.

60. (Original) The bone screw of claim 43, wherein each edge forms a substantially circular shape.

61. (Original) The bone screw of claim 43, wherein each edge is substantially sharp.

62. (Currently Amended) A bone fixation assembly comprising:  
a bone fastener comprising a head, a shank having threads to be anchored into bone, and a plurality of disk-shaped collars, each the collar having a top surface, a bottom surface and a lateral sidewall extending between the top surface and the bottom surface, the intersection of the lateral sidewall with the bottom surface forming a substantially sharp edge portion and a plurality of lower portions, at least two adjacent lower portions forming at least one circular edge; and  
a receiving member comprising at least one bore that defines an inner surface with a first cylindrical portion and a second non-cylindrical portion,  
wherein the diameters of the collars are sized and configured so that they decrease from the head to the shank so that the sharp edges of the collars form an imaginary convex surface, each of the sharp edges contacting and the second non-cylindrical portion contact one another along the at least one circular edge.

63. (Canceled)

64. (Canceled)

65. (Canceled)

66. (New) The bone fixation assembly of claim 1, wherein the first portion is cylindrical and the concave portion is spherical.

67. (New) The bone fixation assembly of claim 1, wherein the receiving member is a bone plate.

68. (New) The bone fixation assembly of claim 67, wherein the bore formed in the bone plate includes an internally threaded portion for receiving a grub screw so that rotation of the grub screw presses the grub screw against the head of the bone fastener to fix the position of the bone fastener with respect to the bone plate.

69. (New) The bone fixation assembly of claim 1, wherein the receiving member interconnects the bone fastener to a longitudinal spinal rod.

70. (New) The bone fixation assembly of claim 69, wherein the receiving member further includes a transverse channel for receiving the longitudinal spinal rod and clamping means for fixing the position of the longitudinal spinal rod with respect to the bone fastener.

71. (New) The bone fixation assembly of claim 1, wherein the head of the fastener is removably attached to the shank of the fastener.

72. (New) The bone fixation assembly of claim 71, wherein the head of the fastener includes a conical peg and the shank of the fastener includes a bore so that the head is attached to the shank by a cone connection.

73. (New) The bone fixation assembly of claim 71, wherein the head of the fastener includes a threaded peg and the shank of the fastener includes a threaded bore so that the head is attached to the shank by a screw connection.

74. (New) The bone fixation assembly of claim 71, wherein the head of the fastener includes a peg with a radially protruding pin and the shank of the fastener includes a bore with a groove sized and configured to receive the pin so that the head is attached to the shank by a bayonet type connection.

75. (New) The bone fixation assembly of claim 1, wherein the fastener includes a plurality of collars, each collar being arranged in-between the head of the bone fastener and the shank of the bone fastener.

76. (New) The bone fixation assembly of claim 75, wherein each collar is circular with a diameter and the shank of the fastener has a diameter, the diameters of the collar being greater than the diameter of the shank.

77. (New) The bone fixation assembly of claim 76, wherein the collars are arranged so that the diameters of the collars decrease as one moves from the head of the fastener towards the shank of the fastener so that the collars form a plurality of stepped edges.

78. (New) The bone fixation assembly of claim 77, wherein the stepped edges of the collars form an imaginary convex surface.



79. (New) The bone fixation assembly of claim 76, wherein the concave portion of the bore has a diameter D so that the diameter of the collars are less than the diameter D of the bore.

80. (New) The bone fixation assembly of claim 79, wherein the ratio of the diameters of the collars to the diameter D of the bore is 0.5 to 1.0.

81. (New) The bone fixation assembly of claim 80, wherein the ratio of the diameters of the collars to the diameter D of the bore is 0.85 to 0.95.

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